

2 **WHAT IS CLAIMED IS:**

1 1. A confocal interferometry system for making interferometric measurements of
2 an object, the system comprising:

3 an array of pinholes positioned to receive a source beam and, for each pinhole in
4 the array of pinholes, separate the source beam into a corresponding reference beam on
5 one side of the array of pinholes and a corresponding measurement beam on the other
6 side of the array of pinholes;

7 a first imaging system arranged to image the array of pinholes onto an array of
8 spots on or in the object so that the corresponding measurement beam for each pinhole of
9 the array of pinholes is directed to a different corresponding spot of the array of spots and
10 produces for that spot a corresponding return measurement beam, said first imaging
11 system also arranged to image the array of spots onto the array of pinholes so that the
12 corresponding return measurement beam from each spot of the array of spots is directed
13 back to a corresponding different pinhole in the array of pinholes, wherein for each
14 pinhole the pinhole array combines the return measurement and reference beams for that
15 pinhole to produce a corresponding combined beam; and

16 a detector assembly including an array of detector elements aligned with the array
17 of pinholes so that the corresponding combined beam for each pinhole is directed to
18 different corresponding detector element of the array of detector elements.

1 2. The confocal interferometry system of claim 1 further comprising a second
2 imaging system that images the array of pinholes onto the array of detector elements.

1 3. The confocal interferometry system of claim 1 wherein the first imaging
2 system comprises:

3 a beam splitter positioned to receive, for each pinhole, the corresponding
4 measurement beam and separate that corresponding measurement beam into a transmitted
5 portion and a reflected portion; and

6 a reflecting surface positioned to image each pinhole of the pinhole array onto a
7 corresponding spot on or in the object via the beam splitter and thereby direct the
8 measurement beam from that pinhole onto said corresponding spot.

1 4. The confocal interferometry system of claim 3 wherein the reflecting surface is
2 substantially concentric with a point on the object.

1 5. The confocal interferometry system of claim 4, wherein the first imaging
2 system further comprises a refracting surface positioned between the object and the beam
3 splitter to receive light rays from the object.

1 6. The confocal interferometry system of claim 5, wherein the reflecting surface
2 substantially conforms to a sphere having a first radius and the refracting surface
3 conforms to a sphere having a second radius, wherein the first radius is greater than the
4 second radius.

1 7. The confocal interferometry system of claim 6, wherein the reflecting surface
2 and the refracting surface have the same center of curvature.

1 8. The confocal interferometry system of claim 4, wherein the first imaging
2 system further comprises a refracting surface positioned between the beam splitter and
3 the pinhole array to receive light rays focused by the reflecting surface.

1 9. The confocal interferometry system of claim 3 wherein the reflecting surface is
2 substantially concentric with an image point on the pinhole array.

1 10. The confocal interferometry system of claim 9, wherein the first imaging
2 system further comprises a refracting surface positioned between the pinhole array and
3 the beam splitter to receive light rays from the pinhole array.

1 11. The confocal interferometry system of claim 10, wherein the reflecting
2 surface substantially conforms to a sphere having a first radius and the refracting surface
3 conforms to a sphere having a second radius, wherein the first radius is greater than the
4 second radius.

1 12. The confocal interferometry system of claim 11, wherein the reflecting
2 surface and the refracting surface have the same center of curvature.

1 13. The confocal interferometry system of claim 3 wherein the first imaging
2 system further comprises a second reflecting surface on the other side of the beam splitter
3 from the first-mentioned reflecting surface and positioned to image each pinhole of the
4 pinhole array onto its corresponding spot on or in the object via the beam splitter.

1 14. The confocal interferometry system of claim 13 wherein the first-mentioned
2 reflecting surface is substantially concentric with a point on the object and the second
3 reflecting surface is substantially concentric with the image point on the pinhole array.

1 15. The confocal interferometry system of claim 14, wherein the first imaging
2 system further comprises a first refracting surface positioned between the object and the
3 beam splitter to receive light rays from the object and a second refracting surface
4 positioned between the beam splitter and the pinhole array to receive light rays focused
5 by the reflecting surface.

1 16. The confocal interferometry system of claim 15, wherein the first-mentioned
2 reflecting surface substantially conforms to a sphere having a first radius and the first
3 refracting surface conforms to a sphere having a second radius, wherein the first radius is
4 greater than the second radius.

1 17. The confocal interferometry system of claim 16, wherein the first-mentioned
2 reflecting surface and the first refracting surface have the same center of curvature.

1 18. The confocal interferometry system of claim 15, wherein the second
2 reflecting surface substantially conforms to a sphere having a first radius and the second
3 refracting surface conforms to a sphere having a second radius, wherein the first radius is
4 greater than the second radius.

1 19. The confocal interferometry system of claim 18, wherein the second
2 reflecting surface and the second refracting surface have the same center of curvature.

1 20. The confocal interferometry system of claim 19, wherein the first-mentioned
2 reflecting surface and the second reflecting surface have the same radius of curvature.

1 21. The confocal interferometry system of claim 20, wherein the first-mentioned
2 reflecting surface and the second reflecting surface have respective centers of curvature
3 that are conjugate points with respect to the beam splitter.

1 22. The confocal interferometry system of claim 20, wherein the pinhole array is
2 a two-dimensional array.

1 23. The confocal interferometry system of claim 22, wherein the two-
2 dimensional array is of equally-spaced holes.

1 24. The confocal interferometry system of claim 23, wherein the equally-spaced
2 holes are circular apertures.

1 25. A confocal interferometry system for making interferometric measurements
2 of an object, the system comprising:

3 an array of pinholes positioned to receive a source beam and, for any selected
4 pinhole in the array of pinholes, separate the source beam into a corresponding reference
5 beam on one side of the array of pinholes and a corresponding measurement beam on the
6 other side of the array of pinholes;

7 a first imaging system arranged to image the array of pinholes onto an array of
8 spots on or in the object so that the corresponding measurement beam for said any
9 selected pinhole is directed to a corresponding spot of the array of spots and produces for
10 that spot a corresponding return measurement beam, said first imaging system also
11 arranged to image the array of spots onto the array of pinholes so that the corresponding
12 return measurement beam from said given spot is directed back to said any selected
13 pinhole, wherein the pinhole array combines the corresponding reference and return
14 measurement beams to produce a corresponding combined beam; and

15 a detector assembly including an array of detector elements aligned with the array
16 of pinholes so that the corresponding combined beam for each pinhole is directed to
17 different corresponding detector element of the array of detector elements.

1 26. The confocal interferometry system of claim 25 further comprising a second
2 imaging system that images the array of pinholes onto the array of detector elements.

1 27. The confocal interferometry system of claim 25 wherein the first imaging
2 system is a catadioptric imaging system.

1 28. A confocal interferometry system for making interferometric measurements
2 of an object, the system comprising:

3 a mask defining a pinhole positioned to receive a source beam and separate the
4 source beam into a reference beam on one side of the pinhole and a measurement beam
5 on the other side of the pinhole;

6 a first imaging system arranged to image the pinhole onto a spot on or in the
7 object so that the measurement beam is directed to said spot and produces for said spot a
8 return measurement beam, said first imaging system also arranged to image said spot
9 onto the pinhole so that the return measurement beam from said spot is directed back to
10 said pinhole, wherein the pinhole combines the return measurement and reference beams
11 to produce a combined beam; and

12 a detector system including a detector element that receives the combined beam.

1 29. The confocal interferometry system of claim 28 further comprising a second
2 imaging system that images the pinhole onto the detector element so that the combined
3 beam is directed to the detector element.

1 30. The confocal interferometry system of claim 28 wherein the first
2 imaging system is a catadioptric imaging system.

3